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DIRECTORATE OF
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Intelligence Memorandum

The Effectiveness of the Rolling Thunder Program

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
23 May 1967

INTELLIGENCE MEMORANDUM

The Effectiveness of the Rolling Thunder Program

Summary

Despite the increased tempo of the air war during the last 10 weeks, the Rolling Thunder program has made only limited progress in meeting two of its current objectives: to limit or raise the cost of sending men and supplies to South Vietnam and to make North Vietnam pay a price for its aggression against the South. The damage to economic and military targets has not degraded North Vietnam's ability to support the war sufficiently to affect current levels of combat in the South. There are no signs that the determination of the regime to persist in its aggression has abated and despite increasing hardships, the morale of the populace has not eroded to a point where widespread apathy and war weariness are threatening the control of the Hanoi regime. The recent expansion of the bombing program has, however, badly damaged the modern sector of the North Vietnamese economy and has increased the disruption of orderly economic activity.

The cost of bomb damage to North Vietnam continues to rise. Total damage resulting from air attacks through April 1967 is estimated to be over \$233 million. Over 70 percent of this damage was inflicted on economic target systems. However, despite the increasing costs and burdens resulting from the air attacks, North Vietnam, aided by an increased flow of imports from the USSR and Communist China, has managed to maintain, and in many respects to improve its organized support of the war.

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The electric power industry has been the most heavily damaged sector of the economy and its neutralization may paralyze almost all of the modern industrial sector. This sector, however, makes only a marginal contribution to the war effort. Other important activities have been subjected to heavy attack--transportation and petroleum storage--but North Vietnam has successfully implemented countermeasures so that the over-all performance and capabilities of these activities are as high, if not higher, than when the bombing programs started.

The attacks on military target systems through April 1967 had not significantly reduced the capabilities of the military establishment. These capabilities have, in fact, been greatly expanded through large infusions of military aid from the USSR and Communist China.

The ability of North Vietnam to withstand the pressures of air attacks is explained by several factors. The economy is essentially agrarian and provides little direct input, other than manpower, to the war in the South. The flow of essential economic and military aid into North Vietnam far surpasses the total damage resulting from air attacks and provides North Vietnam the materials necessary to continue the war. This assistance also implies that the USSR and Communist China will underwrite the damage sustained and the eventual reconstruction of the country, as they did in North Korea after the war. Finally, the North Vietnamese have devised and implemented an elaborate and highly successful system of countermeasures which negates most of the desired impact of air attacks on the vital flow of men and supplies to the war in the South.

Experience indicates that the remaining land transportation targets will be extremely difficult and costly to interdict. Even with a more concentrated bombing effort against lines of communication in the southern part of North Vietnam, it will be extremely difficult to reduce significantly the southward flow of supplies. More than 300 miles of road were either upgraded or newly constructed in this area during the latter half of 1966 in order to reduce the reliance on the heavily bombed main

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routes such as 1A and 15. In addition, there has been widespread development of bridge bypasses, including cable bridges, pontoon bridges, fords, and ferries. The capacity of the highway and waterway systems is far in excess of the comparatively small volume of supplies required. Both of these systems are difficult to interdict and movements at night probably would enable the Communists to meet supply requirements without serious difficulty.

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I. The Rising Tempo of the Air War

1. The tempo of the air war over all areas of North Vietnam increased significantly during the last two and one-half months as a result of new strikes against airfields, electric power facilities, and manufacturing plants at the same time that lines of communication, barracks, and supply depots were being struck with increased intensity. During January-February a total of 12,050 attack sorties were flown against North Vietnam. In the period 1 March - 15 May about 23,00 attack sorties were flown. The number of attack sorties flown against route packages V and VI in the northern areas of North Vietnam increased by about 70 percent between the same periods, from 1,130 in the first two months of 1967 to over 1,900 during the period 1 March - 15 May.

2. Air strikes against the rail system have increased considerably in recent weeks. Numerous facilities on the key Hanoi - Dong Dang line have been attacked seriously for the first time since September 1966. Strikes on the Hanoi rail and highway bridge across the Canal des Rapides have closed the line to through traffic until a by-pass bridge is built. Goods continue, however, to be shuttled across the canal. The level of damage to the road system is also much higher than a year ago. Since 29 March four airfields have been attacked a total of six times. Even targets that have been hard hit in the past--petroleum storage and military barracks--have come under heavy attack in recent weeks.

3. The attacks against major industrial targets during the past several weeks are evidence of the changing nature of the air war over North Vietnam. During the first two months of 1967 only 4 missions were flown against 2 thermal power plants. Since 1 March, 22 missions were flown against 6 power plants and 1 major substation. For the first time under the Rolling Thunder Program, preplanned attacks were carried out against major industrial installations--the Thai Nguyen iron and steel combine and the Haiphong cement plant. Thai Nguyen has been struck 14 times since 10 March and the Haiphong cement plant 2 times since 20 April. The tabulation below illustrates the general step-up in air operations that have occurred since 1 March 1966.

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	<u>January-February 1967</u>		<u>March - 14 May 1967</u>	
	<u>Targets</u>	<u>Missions</u>	<u>Targets</u>	<u>Missions</u>
Electric Power	2	4	7	22
Manufacturing	0	0	2	16
Airfields	0	0	4	6
Railroad Yards				
and Shops	5	31	7	45
Barracks	8	24	13	80
Petroleum Storage	2	2	3	7
Naval Bases	0	0	2	4
Maritime Ports	<u>1</u>	<u>4</u>	<u>0</u>	<u>0</u>
	18	65	38	180

II. Electric Power

A. The 1967 Campaign

4. Damage or destruction resulting from concentrated attacks against electric power facilities have put out of operation virtually all of North Vietnam's central generating capacity with the possible exception of the power plant at Hanoi.

5. In the first two months of 1967 two power plants--Hon Gai and Bac Giang--came under attacks for the first time. It was not until March, however, that a concentrated and systematic attack against the major remaining power facilities in North Vietnam got under way. Since 1 March a total of 261 sorties have been flown against power facilities and almost 500 tons of bombs have been dropped against such facilities. In April and May the two power plants in Haiphong were attacked for the first time. The results of strikes carried out on 19 and 21 May against the power plant at Hanoi, the last undamaged plant in the central power network, are unknown. A summary of air operations against North Vietnamese thermal power plants in 1967 is given in the following tabulation:

January-February

<u>Plant Attacked</u>	<u>Attack Sorties</u>	<u>Ordnance (tons)</u>
Bac Giang	3	18
Hon Gai	<u>5</u>	<u>27</u>
	8	45

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March - 14 May

<u>Plant Attacked</u>	<u>Attack Sorties</u>	<u>Ordnance (tons)</u>
Bac Giang	15	56
Hon Gai	40	57
Viet Tri	27	96
Thai Nguyen	9	29
Haiphong West	76	80
Haiphong East	36	72
Hanoi	6	3
Hanoi Transformer Station	52	106
	<u>261</u>	<u>499</u>

B. Effects on the Electric Power Industry

6. Through the middle of May 1967 the Rolling Thunder program had attacked 13 [REDACTED] electric power facilities in North Vietnam. The air campaign has put out of operation 131,000 kilowatts (kw) of capacity in the main Hanoi-Haiphong power network and in two smaller power systems in the southern part of the country. The loss represents 70 percent of total national installed capacity of 187,000 kw. The cost of restoring these facilities is estimated at \$20.5 million.

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7. The air attacks have reduced capacity in the main network from eight plants with a total capacity of 136,000 kw to a single plant at Hanoi with a capacity of 32,500 kw, or about 24 percent of the prestrike level. If the Hanoi power plant has been put out of operation, practically the entire main network is inoperative.

C. Effects on the Economy

8. The neutralization of most of North Vietnam's electric power industry is having widespread effects throughout the country. The loss of generating facilities undoubtedly has created a severe shortage of power and disrupted activities that normally depend on a reliable central power supply. It is probable that nonessential consumption by residences and commercial establishments, and most street lighting have been practically eliminated. The few heavy or continuous-process

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industries, such as the Viet Tri chemical and paper complex or the Haiphong cement plant,* probably have been forced to stop operations unless some provision for power has been made by the installation of diesel-generating units larger than those currently estimated to be available. Industrial or manufacturing processes that can be divided into small segments (such as machine shops, truck repair facilities, coal mining, or port loading operations) can probably be furnished sufficient power by small diesel generating units, but not without some loss of efficiency. Most of the industrial operations closely related to North Vietnam's support of the war in the South are of the type that can be operated by small diesel units. Thus, the curtailment or shutdown of modern industry would have relatively little impact on North Vietnam's ability to continue the war.

9. There are few eye-witness reports about the impact of power shortages. The first positive indication that generating capacity now falls short of meeting demands was a reported announcement that power rationing was instituted in Hanoi on 10 May 1967. A few other reports have suggested intermittent restrictions on power supply over the past year.

D. Restoration of Damaged Facilities

10. The electric power industry has been the major exception to North Vietnam's demonstrated ability to recuperate from the air attacks. Although complete restoration of the damaged facilities would require 18-24 months, most of them could be restored to partial operation within a period of 2-4 months.

11. There are signs of strain and bottlenecks in North Vietnamese attempts to rebuild the damaged power facilities. Most of the reconstruction requires foreign technical and material assistance. Much of the progress made during 1966 was eliminated by later re-strikes against the power facilities. There is considerable variation in the effort assigned to various reconstruction programs. When limited damage permits

*This plant also sustained bomb damage in April 1967.

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equipment to be readily salvaged, the North Vietnamese have made persistent efforts to restore facilities to partial operation. They are willing to abandon plants, however, when a major reconstruction effort is required.

E. Countermeasures

12. North Vietnam is estimated to have imported around 2,000 diesel-driven generating units during the past two years.

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13. Those diesel units are well-suited for supplying power to small independent consumers, but they cannot be readily operated in parallel with a transmission network, nor are they large enough to cover the demands of heavy, continuous-process industry. Moreover, the usable capacity of these units will be substantially less than their rated capacity. The diesels known to have been imported probably could not supply more than 15,000 kw to 20,000 kw of usable power. This amount is roughly 10 percent to 15 percent of the central generating capacity currently out of operation.

14. A concerted effort probably will be made to maintain minimal power supply in Hanoi and Haiphong with available generating capacity. These cities probably have been allocated the larger-sized diesel units to serve select parts of the cities, possibly through existing low-voltage distribution lines. It is reasonable to assume that some diesel units have been allocated for use in the areas of Thanh Hoa, Ben Thuy, and Hon Gai where central plants are out of operation. Some undoubtedly have been assigned to supply power for irrigation and drainage of agriculture, and some will be assigned a standby role for emergency power. Although a number of alternatives are open to the North Vietnamese in the use of diesels,

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it seems clear that available generating capacity falls so far short of meeting demands that some system for rationing electricity is imperative.

III. Manufacturing

A. The 1967 Campaign

15. Prior to 1967 only one manufacturing plant--the Lang Chi explosive plant--had been purposely struck. On several occasions, the Nam Dinh textile mill and Cam Pha coal treatment plant had been hit inadvertently. The Viet Tri paper mill also had been hit on at least one occasion. It was not until March 1967 that major industrial targets--the Thai Nguyen iron and steel combine and the Haiphong cement plant--were brought under concentrated attack. Between 3 March - 16 May the Thai Nguyen iron and steel combine was struck 14 times with about 580 tons of bombs. The Haiphong cement plant was struck on two occasions in April. A summary of strikes against these targets is given below.

<u>Target</u>	<u>Attack Sorties</u>	<u>Ordnance (tons)</u>
Thai Nguyen Iron and Steel Combine	237	580
Haiphong Cement Plant	43	50

B. Bomb Damage

16. It is probable that damage to the steam plant, coke oven and ancillary facilities combined with the general shortage of electric power have temporarily stopped the production of pig iron at Thai Nguyen. As of this date, it cannot be confirmed that direct damage has been done to the blast furnaces.

17. In assessing damage to Thai Nguyen it is important to bear in mind that the plant, as an iron and steel producer, was never completed and much of the steel making and rolling mill equipment probably has never been installed.

18. The North Vietnamese have used the numerous fabrication shops and other facilities at Thai Nguyen for the fabrication of significant quantities of war-support production--barges, small watercraft, pontoons, petroleum storage tanks, and construction materials from imported steel. The war-supporting production

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at Thai Nguyen has undoubtedly been disrupted by the bombings, but it can probably be restored in relatively short order.

19. The Haiphong cement plant is believed to be inoperative both because of the air strikes on 20 and 25 April 1967 and also because of the loss of electric power from the damaged Haiphong West thermal power plant. Partial operation of the plant probably could be achieved in 90 days. However, it is highly unlikely that the plant would be restored to full capacity until after the cessation of the bombings. The loss of cement output will deprive North Vietnam of one of its few earners of foreign exchange and will increase its import requirements for this item.

IV. Transport Capability and Performance

20. Air strikes against the transport system of North Vietnam have not significantly affected transport capability or the ability to move supplies --either into or within the country--in support of the economy or the war effort. There has been little indication throughout the country of serious supply shortages or bottlenecks. Rail, highway, and inland water connections between North Vietnam and Communist China have the capacity to accommodate the movement of supplies far in excess of the current volume being imported. Thus, the recent increased interdiction of the important Hanoi - Dong Dang rail line has not seriously affected the flow of imports since traffic, delayed because of interdictions on the line, can be moved after repairs are made. In the southern part of North Vietnam, the over-all capacity of the road network has been generally maintained or slightly improved despite concentrated air attacks and an increase in the damage level. In fact--despite recently increased levels of damage to highways, trucks, and watercraft--the number of both trucks and water craft sighted moving south of Thanh Hoa increased significantly. During the first week in May, truck movement in and out of Laos on Route 15 (south of Vinh) was greater than during the Tet standdown in February when the North Vietnamese had free use of the road. Also, large convoys of trucks--one reported to number about 100 trucks--were detected during May on Route 1A moving

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toward the DMZ. This increased truck and water craft activity probably is in support of recent military activities by the sizeable North Vietnamese forces in that area.

21. The ability of North Vietnam to expand the level of imports and to continue the distribution of supplies within the country also was made possible by the effectiveness of a variety of measures undertaken to counter the damage inflicted on the transport system. Multiple stream crossings on important lines of communication have ensured at least one serviceable crossing most of the time despite concentrated air attacks. This has been possible because of the mobilization of a large work force, the use of on-site building materials to carry out repairs, and preplanning and rapid implementation of repair and construction work on the lines of communication. On the important Hanoi - Dong Dang rail line, at least one bypass bridge has been built for each bombed bridge--

The North Vietnamese were observed constructing a bypass bridge for the major Hanoi rail highway bridge over the Canal des Rapides in May 1966, one year before the bridge was struck. Therefore, when the bridge was destroyed on 29 April 1967, the bypass bridge could be made operational within 15 to 30 days after the strike--and it is possible that the bridge decking can be removed during the day. When two 50-foot spans on the rail/highway bridge at Bac Giang (also on the Dong Dang line) were dropped on 29 April, the bridge was repaired and serviceable by 1 May. Bypass bridges on this line have been well built, substantial structures, and probably were erected by a Chinese railway engineering division

22. Important crossings on the rail line south of Hanoi have been furnished with the most numerous bypasses. There are six bypasses in place at the site of the Dong Phong Thuong rail/highway bridge and four bypasses in place at the Qui Vinh railroad bridge. In the southern part of the country, there has been considerable use of fords, ferries, and pontoon bridges to bypass damage to highway bridges. The North Vietnamese have not only been able to generally keep main roads open, but they have also upgraded many rural roads and constructed new roads in the southern part

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of the country to reduce their reliance on the heavily bombed main routes such as 1A and 15. More than 300 miles of roads were upgraded or newly constructed in Route Packages 1, 2, and 3 during the latter half of 1966.

V. Transport Equipment

23. Destruction and damage of transport equipment, especially trucks and watercraft, increased during the period 1 March - 14 May, 1967 compared to January-February 1967. Losses of watercraft rose dramatically to a total much greater than the 1966 quarterly average and higher than the 1965 total. Truck destruction and damage increased over the first two months, with sightings during early May increasing significantly. Attrition of rail freight cars increased slightly the last two months, based on the increased levels of damage.

24. While the level of damage inflicted during 1966 was significantly higher than in 1965, and while the level of damage appears to be increasing during 1967, there is no evidence of serious transport problems resulting from equipment shortages. Imports of trucks have been sufficient to maintain inventory levels. While information on imports of rolling stock is sketchy and not at all equal to the attrition rate, there is no indication of any problems associated with rail equipment shortages. Sightings of rail cars in the badly interdicted rail yards south of Hanoi indicate rail car inventory is more than sufficient for needs. In addition, reported losses of railroad rolling stock have included many small, makeshift cars used south of Hanoi which are not included in the inventory. Sightings of watercraft, which increased to record levels in the beginning of May, indicate there has been no significant decrease in the watercraft employed despite the high level of destruction. The reported losses of transport equipment during 1967 are shown in the following tabulation:

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Comparative Losses to Transport Equipment

Jan-Feb, 1967 and Mar - 14 May 1967

<u>Type</u>	<u>Jan-Feb, 1967</u>		<u>Mar - 14 May 1967</u>	
	<u>Destroyed</u>	<u>Damaged</u>	<u>Destroyed</u>	<u>Damaged</u>
Locomotives	0	2	0	0
Railroad Rolling Stock	56	51	43	104
Trucks	104	92	284	328
Ferries	0	1	0	0
Barges	259	820	899	1,732
Other watercraft	54	216	38	42

VI. Petroleum Storage Facilities

25. On 1 January 1965 North Vietnam had 13 fixed petroleum storage facilities with a combined capacity of about 128,000 tons [redacted] By the end of 1966 about 85 percent of this capacity was destroyed. Attacks during early 1967 inflicted only minor additional damage to the system by destroying the residual capacity at Do Son.

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26. An effective dispersed storage system and modified Soviet delivery schedules and techniques have blunted the effects of the destruction of North Vietnam's bulk storage facilities. There is no evidence that the bombing of petroleum targets has seriously weakened the economy, produced significant shortages of petroleum, or diminished North Vietnam's capability to support military activities or the infiltration of men and supplies into Laos and South Vietnam.

VII. Railroad Yards and Shops

27. Several significant rail facilities have been attacked during 1967, with the most significant strikes occurring during April and May. During April the Hanoi railroad car repair shops and classification yard, Gia Lam was attacked, destroying an estimated 16 percent of the floor plan area of repair buildings and 27 percent of the floor plan area of support buildings. This facility represents 65 percent of North Vietnam's railroad car repair capacity and was initially struck in

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1966, when an estimated 6 percent of capacity was destroyed. Damage to this facility will probably temporarily disrupt the repair of freight cars, although repair activity can be dispersed and conducted at local levels.

28. During May the important rail classification yard at Yen Vien, which is at the crossroads of the Hanoi - Dong Dang and Hanoi - Lao Cai lines, was attacked. As all traffic from Lao Cai and Dong Dang must use this yard before entering Hanoi, strikes against it have probably interrupted service on both lines.

29. Other facilities struck from March through May include the yards at Vinh, Thanh Hoa, Nam Ding, Ninh Binh, and Thai Nguyen, all of which were struck during January and February 1967, and during 1966. The most important of these is at Thai Nguyen, which serves the steel complex and accounts for about 9 percent of total North Vietnamese capacity. Cumulative results show that about 90 percent of rail yard capacity and 50 percent of repair facilities have been destroyed at Thai Nguyen.

30. While the level of air strikes against rail facilities has increased since 1965, when only Vinh, Nam Dinh, and Yen Bai were attacked, the cumulative effects have not been disastrous to the rail system as a whole. Repairs are very effectively and easily accomplished. In several instances bypass tracks have been noted laid around the rail yard, decreasing the effectiveness of air strikes and assuring through service. The air strikes against rail yards and shops probably have temporarily disrupted but not adversely affected the rail capability.

VIII. Airfields

31. North Vietnam's jet airfield capacity remained virtually unattacked throughout 1965, 1966, and the first two months of 1967. Only four minor airfields--two of which had limited jet capacity--had been struck and inactivated in 1965. Then on the 29th of March 1967, US aircraft began to interdict North Vietnam's major airfields capable of handling jet aircraft. Kep and Haiphong/Kien An airfields have been struck in rapid succession.

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32. Preliminary bomb damage assessment returns indicate that these attacks were generally unsuccessful in limiting air operations. The light to moderate damage inflicted could be repaired within 30 days. One side of the runway at Kep has been cratered, but fighter aircraft should be able to use the other side of the runway. Damage to Hoa Lac airfield (initially struck 24 April) and Haiphong/Kien An airfield (initially struck 10 May) was light. According to JCS estimates, only 23 percent of North Vietnam's airfield capacity is destroyed or inactive. However, even if the capacities at Kep and Hoa Lac were completely lost, North Vietnam's ability to mount air operations would not be seriously impeded.

33. North Vietnam's fighter aircraft facilities, which were inadequate at the beginning of the bombing, have been expanding significantly, outpacing the growth of the MIG inventory to the point where slack capacity now exists. At least six airfields are presently capable of supporting MIG operations, and an additional airfield under construction at Bai Thuong will be able to accommodate jets when it is completed. Successful attacks against the major airfields at Kep and Phuc Yen would somewhat reduce fighter effectiveness over the capital area, but the North Vietnamese would still be capable of maintaining an aggressive fighter force.

34. Effective interdiction of all North Vietnamese jet capable airfields would force North Vietnamese aircraft into China--possibly to Peitun/Yunnani, Nanning, Ning Ming, or other airfields. From these bases, North Vietnamese aircraft would be far less effective in defending the Hanoi/Haiphong area due to protracted reaction times and high fuel requirements.

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